ENVIRONMENTAL AWARENESS

LESSON 1-2: ENVIRONMENTAL ISSUES

PURPOSE

Most of us take for granted our existence on this earth — the air we breathe, the water we drink, and the land upon which we live, work, and play. We do not stop to think about why the air and water are relatively clean and the land is relatively free from **pollution**. This chapter will help you to become more sensitive to environmental issues, thoughtful in your actions, and aware of the contributions that you can make to help protect your environment.

air emissions
ash
combustion
composting
incineration
landfill
leachate
liners
methane
pelletize
pollutants
pollution
recycling
searing
solid waste
source reduction
synthetic
toxicity

INTRODUCTION

Most Americans are not aware of decisions that governmental agencies and/or state and federal legislatures make to ensure the purity of our environment or to protect our health — that is, until it affects them directly. Even though environmental issues are often very diverse and technical in nature, many non-technical community leaders and citizens are making the decisions on these issues. Consequently, society is forcing these decision makers to gain a significant understanding of the technology, terminology, and laws governing environmental issues.

After completing this chapter, you should have a better appreciation for the environment around you; know how to safeguard its upkeep; and be prepared to prevent its breakdown.

BACKGROUND: EXAMPLES OF ENVIRONMENTAL IMPACTS

More than a century of advanced technology has taken its toll on the natural environment of North America. For decades, the federal government ignored the growing problems of water and air pollution. A public outcry during the 1960s, however, forced the government to establish the Environmental Protection Agency (EPA) and to take a leading role in enforcing new pro-environmental legislation. The presidential and congressional administrations of the 1970s made substantial progress on environmental issues until the public criticized them again in the 1980s for weakening the federal enforcement structure.

To introduce the complexity of this subject, listed below are three examples of environmental impacts on today's society.

- Various medical geographers and scientists now relate many forms of cancer, especially lung cancer, to environmental conditions. As a result of an intensified effort to study this finding, these experts have discovered that the distribution of respiratory-system cancers in the United States coincides with a number of major manufacturing and refining centers.

- Acid rain is a serious water pollution problem. The region surrounding the United States Manufacturing Belt (particularly Ohio, Illinois, Indiana, and Michigan — which produce about 75 percent of North America's sulfur and nitrogen emissions), is one of the areas worst affected by acid rain.

- Smog is an example of a severe air pollution problem that faces the large metropolitan areas in the United States. Air pollution is the presence of "unwanted material" (substances that are in sufficient concentrations to interfere with a person's health, comfort, welfare, or their enjoyment of property) in the air in excess of certain standards.

  Dozens of major cities experience this hazard, with Los Angeles and Denver among the most frequently exposed. Smog (a contraction of the words "smoke" and "fog") occurs when the warmer atmospheric air prevents cooler surface air from rising, thereby causing the surface air to become stagnant. The stagnant air then traps automobile and industrial emissions, thus intensifying the air pollution.

TYPES OF WASTE MATERIAL

Before discussing the key technological issues of **solid waste** and its disposal, an introduction is in order on the types of wastes and disposal facilities, as well as the different disposal procedures. Listed below are the major categories of wastes that communities must pick-up, transport, process, landfill, and/or take appropriate measures for disposal.

Domestic or Household Waste. Solid waste, comprised of garbage and rubbish, that normally originates in the household.

Garbage. Solid waste that consists of *putrescible* (defined on the next page) animal and vegetable waste materials, resulting from the handling, preparation, cooking, and consumption of food. It also includes waste materials from markets, and storage facilities, as well as the handling and sale of produce and other food products.

Hazardous Waste. Waste that because of its quantity; concentration; or physical, chemical, and/or infectious characteristics may pose a substantial hazard to human health or to the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

Inorganic Waste. Non-combustible waste material made from substances composed of matter other than plant, animal, or

certain chemical compounds of carbon (for example, metals and glass).

Municipal Solid Waste. Waste that includes non-hazardous material generated in households, commercial and business establishments, and institutions. It excludes industrial-process, demolition, agricultural, and mining wastes; abandoned automobiles; ashes; street sweepings; and sewage sludge.

Organic Waste. Waste material that consists of substances composed of carbon and hydrogen compounds that are generally manufactured in the life processes of plants and animals. It includes paper, wood, food wastes, plastics, and yard wastes.

Putrescible Waste. Decaying solid wastes that can decompose rapidly causing foul odors and possibly attracting animals and/or disease carrying insects.

Residential Waste. Waste material generated in houses and apartments. It includes paper, cardboard, beverage and food cans, plastics, food wastes, glass containers, old clothes, garden wastes, etc.

Solid Waste. Garbage, refuse, sludges, and other discarded solid materials including those from industrial, commercial, and agricultural operations, and from community activities. It does not include solids or dissolved materials in domestic sewage or other significant **pollutants** in water resources, such as silt.

TYPES OF DISPOSAL FACILITIES AND PROCEDURES

Collection is the service of picking up and moving solid waste from its location of generation to a disposal area or facility, such as a transfer station, resource recovery facility, or **landfill**. Most disposal facilities have the necessary equipment and required land area to receive and dispose of wastes. These facilities may operate one or more disposal methods.

A sanitary landfill is just one method of disposing refuse on land without creating nuisances or hazards to public health or safety. Communities must ensure careful preparation of the fill area and control of water drainage to assure proper landfilling. To confine the refuse to the smallest practical area and reduce it to the smallest practical volume, facilities use heavy tractor-like equipment. This equipment spreads, compacts, and usually covers the waste daily with at least six inches of compacted soil.

The modern, properly engineered sanitary landfills have compacted clay or artificial (plastic) **liners**, **leachate** collection systems (which remove the leachate for

treatment and disposal), and/or systems to collect and remove **methane** gas generated in the landfill.

These modern facilities also use volume reduction to decrease the amount of space the waste materials occupy. Such facilities use three major processes to accomplish volume reduction.

- Mechanical Process — Uses compacting techniques (baling, sanitary landfills, etc.) and shredding.
- Thermal Process – Uses heating techniques (**incineration**) and can reduce volume by 80 to 90 percent.
- Biological Process — Uses bacterial action (**composting**, etc.) to degrade the organic waste.

SOLID WASTE ISSUES

EFFECT ON WATER SUPPLY

In the past, communities used unlined landfills that allowed for the contamination of groundwater — a source of drinking water in some areas. This exposure of small quantities of chemical waste leaching into an unfiltered groundwater supply can result in human health risks.

Today, communities operate state-of-the-art structures (sanitary landfills) to limit water pollution through the use of **synthetic** liners that guide the wastewater to a separate treatment system. To assist communities in these efforts and reduce the number of contaminated sites, the U.S. Congress passed the *Comprehensive Environmental Response, Compensation and Liability Act*. This law imposes strict liability measures for hazardous waste pollution and creates a "superfund" of money to clean up the worst hazardous waste sites across the country.

Other landfill problems facing communities are cost, intolerance, and odor. First, it is very costly and difficult for communities to close a landfill that is at its capacity or to site a new landfill. There are also costs associated with transporting the solid waste to another facility.

Intolerance can become a major problem when citing new landfills because of the "Not In My Back Yard," or NIMBY, concept. Most of us want trash picked up on time, but once collectors pick it up, it is "out of sight and out of mind." Furthermore, few want a landfill in their neighborhood.

EFFECT OF LANDFILL GASES ON AIR QUALITY AND HEALTH

Odors are always a concern of landfills. In an attempt to reduce odors, modern structures install piping and collection systems for the recovery of gases produced by the breakdown of the wastes.

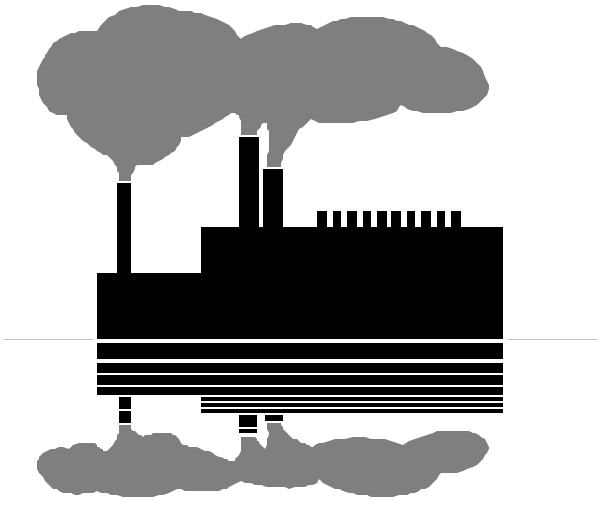
Additionally, landfills risk the possibility of explosion from excessive concentrations of methane (an odorless, explosive gas) as well as the long-term risk of pollution caused by gases escaping into the atmosphere. Since methane comes from the deterioration of organic matter within the landfill, the natural decomposition process over time will result in buried waste giving off methane and water.

Furthermore, the production of methane pockets can continue at a landfill for 10 to 20 years after collectors bury the solid waste products. Because methane is heavier than water, it accumulates and seeks the lowest point. Its accumulation and subsequent migration can result in explosions in low built structures such as sewers and basements of buildings.

CONTROL OF WASTE VOLUME

Communities can control waste volume through **recycling**, **source reduction**, and incineration. However, to make such controls work, consumers must be willing to separate recycled goods and reusable containers, and they must be willing to purchase recyclable products and products made from recycled goods. Otherwise, recycled and/or recyclable products will not survive in a competitive enterprise economy.

Although, incinerators can reduce waste volume and kill bacteria in wastes, their **ash** and **air emissions** can be problematic. Communities must educate their citizens on the technological advances of incineration if they desire community acceptance and cooperation. Furthermore, through the use of established emission standards, community leaders must strictly enforce or regulate the amount of pollutants that landfills or industry discharge into the atmosphere.



Recycling

There are several definitions of recycling waste.

- The commonly accepted meaning is to use discarded materials in their original or changed form rather than wasting them.

- The precise meaning refers to sending material back into the process by which industry first formed it.

- The general meaning refers to the separation of recyclable materials such as newspapers, cardboard/corrugated papers, plastics, glass products, or metals (aluminum, steel, tin, etc.) from the waste system at the point of generation (households, industries, etc.). This also includes the separation and recycling of materials from municipal waste by individuals or specially designed recovery facilities, industrial in-plant recycling, and/or recycling by commercial establishments. Source separation makes recycling simpler and easier.

A successful recycling program must consider the needs of the entire community. Although different communities have different sets of priorities, the following three-step process can apply to any recycling effort.

1. Collect waste materials that have potential value. Collection methods include voluntary measures such as drop-off or curbside service, mandatory curbside service, or private collection (when citizens or firms pay private operating agencies to collect the solid waste — also known as private disposal).

2. Sort or process the above waste materials to a condition useful for industry.

3. Market those materials to industry for manufacture of a useful end product. This step is key to the recycling process. If there is no market to buy the product, recycling

cannot be successful and the community would have to dispose of the recycled goods in another manner after collection.

Many citizens share a common concern for wanting to protect the environment; however, they are uncomfortable with mandatory recycling for two reasons. First, it takes some effort to separate the materials. Secondly, once recycling becomes mandatory within a community, lawmakers may have to impose fines or penalties for those people who do not comply.

Source Reduction

Source reduction is the process of keeping waste out of the waste system through buying practices, conservation, etc. However, source reduction does not by itself solve a community's waste disposal problems.

Communities frequently resort to a combination of options, especially since they must landfill the residue of recycling and take incinerator ash to a landfill for disposal. Therefore, an alternative such as landfill disposal is important even when communities use source reduction and other options.

DID YOU KNOW?

According to the EPA, from 1980 to 1990 the average yearly increase of garbage discarded by each American was 69 pounds.

REAL ENVIRONMENTAL RISKS OF AN INCINERATION SYSTEM

Incineration is an option that communities should consider only after they have explored recycling and source reduction. The remaining trash must go somewhere, and landfill space is becoming increasingly limited in certain communities. The main point of incineration is to reduce consumption of landfill volume.

Often, because of the NIMBY factor, communities do not readily welcome large waste burning facilities. Residents associate landfills with chronic **toxicity** problems (conditions which structures can easily correct with liners), as well as the previously mentioned air pollution and odor concerns.

Even though disposal facilities eliminate 70 to 90 percent of the solid waste volume, communities must landfill the remaining ash. Ash is the residue that remains after a landfill has burned a fuel or solid waste, which consisted primarily of non-combustible materials. The incineration process produces two types of ash: filter (or "fly") ash and bottom ash.

- Fly ash is all solids (including ash, charred papers, cinders, dusty soot, or other matter) that rise with the hot gases from **combustion** rather than falling with the bottom ash. Fly ash is only a minor portion (or about 10 percent) of the total ash produced from combustion of solid waste, but environmentalists consider it to be more toxic than the cinders and metal bits of bottom ash.

- Bottom ash is the non-airborne combustion residue from burning fuel in a boiler. The ash falls to the bottom of the boiler and landfills remove it mechanically. Bottom ash constitutes the major portion (or about 90 percent) of the total ash created by the combustion of solid waste.

The most common types of incinerators are mass-burn plants, refuse-derived fuel facilities, and modular small units (or other types of combustors).

- *Mass-burn Plant*: Takes virtually all non-hazardous waste and burns it collectively.

- *Refuse-derived Fuel Facility*: Separates, crushes, and **pelletizes** waste for burning alone or with fossil fuel.

- *Modular Small Unit*: Includes a variety of different combustion technologies.

Communities currently dispose of ash by mixing truckloads of fly and bottom ash with truckloads of unburned wastes at municipal solid waste landfills. Although these landfills usually do not attempt alternative processing methods to contain the toxic materials found in the ash (leading to potential health problems), governmental agencies are classifying such airborne emissions of gases and toxic chemicals as hazardous under the *Clean Air Act*.

Cost is another factor in using incineration. As of 1990, incineration costs range from $40 to $90 per ton, translating into an additional $30 to $40 per household each year.

JOINING AN ENVIRONMENTAL GROUP

April 22, 1995, marked the 25th Anniversary of Earth Day. Environmental groups from across the country celebrated their accomplishments and pointed to the challenges ahead. These groups range from very large — the Nature Conservancy and Sierra Club — that take on a wide range of environmental efforts, to the smaller, local groups that usually fight more defined battles. They also range from all-purpose to single-minded, from wealthy to poor, and from compromising to confrontational.

While deciding if you want to join any of the dozens of environmental groups, ask yourself, "What does the group really do?" "What level of commitment do I plan to give — time, money, or both?" and, "What will the group expect from me?" Some groups may want you to simply make telephone calls or write letters, whereas others may want you to become involved in environmental restoration projects where you roll up your sleeves and grub around in the soil, muck, and briers.

Whether you join a group or not, remember that environmentalism should start in each person's backyard, grow to consume a neighborhood, and finally, expand until it encompasses the entire community. Frequently, however, the disappointments of these groups outnumber the rewards. Yet, there are many unsung groups that fight difficult bureaucratic battles without drawing much praise. The following is a sampling of national environmental groups:

Defenders of the Environment
Earth Alliance
League of Conservation Voters
Legal Environmental Assistance Foundation
Nature Conservancy
Sierra Club (includes the *Sierra Club Legal Defense Fund*)

CASE STUDY

The city of Grenada has a population of two million people. It has reached a solid waste crisis.

Trashmore, located on the south side of Grenada, is the larger of two solid waste landfills. It accepts over three-fourths of the city's solid waste and has disposal capacity for ten more years. This landfill has existed for 25 years, long before there were any environmental laws governing landfill disposal. Therefore, in addition to household garbage, it also has handled many substances that the government now considers to be hazardous. Trashless, the city's smaller landfill, has reached its capacity. Grenada does not have a recycling program.

Less than three miles from Trashmore is the Grenada River, which is the city's primary source of drinking water. However, a serious drinking water problem exists for the city. Governmental inspectors have discovered that the Trashmore facility does not have a protective liner, causing hazardous substances from the landfill to contaminate the groundwater.

Additionally, residents have reported isolated cases of uncommon illnesses in the area of the landfill, but it is uncertain if the illnesses are the result of the emission of methane gas.

State and federal environmental agencies have contacted the Grenada city council regarding these environmental problems. The council must decide what course of action to take to solve the city's problems. It must exercise one of the following options:

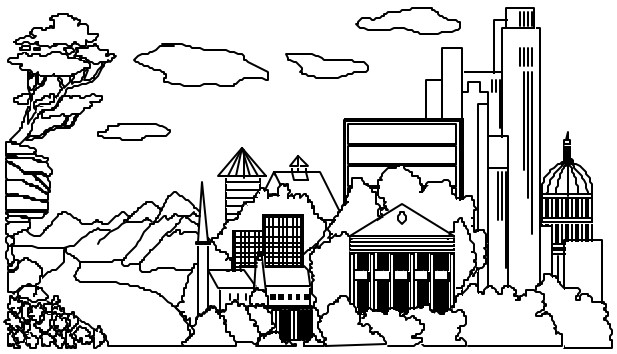
1. Keep Trashmore open since it has the additional capacity.

2. Build a new state-of-the-art landfill.

3. Contract with a commercial disposal facility elsewhere in the city, either temporarily or permanently.

4. Build an incinerator to burn the solid waste.

5. Develop a recycling program. (Consider this option in conjunction with any one of the above options.)



Next, the city has to control and clean up the contamination to the drinking water supply by treating the water with chemicals. This means they must also select a location for and build a new water treatment facility. In the meantime, the city must provide enough drinking water to its citizens, which is a very costly undertaking.

Finally, the city council must deal with its air pollution problem by controlling the methane gas emissions. The council may also want to consider decreasing the use of cars within the city limits. Regarding the air pollution, the city should consider using alternative fuels. For the vehicle problem, one option the council should consider is to create High Occupancy Vehicle (HOV) lanes. These lanes encourage carpooling, thereby reducing the number of vehicles on the road.

The city council is holding a town meeting to consider the options for solving their environmental problems. There are citizens in attendance who have varying opinions on these issues. Many citizens oppose the community locating any facility in their neighborhood. The residents of Southside are particularly strong in their opposition.

Imagine that you are a city-council member. Using the information provided in this lesson and the background information given with the case study, what would you select as the best option for Grenada's landfill problem? Remember that you must also consider the city's water and air pollution problems when determining the best possible course of action. Use the problem-solving/decision-making models to assist you throughout this case study. Be prepared to present the option you select with your reasons to your JROTC instructor.

THE FUTURE: TWO EXAMPLES OF WHAT TO EXPECT

MAN-MADE LIGHTNING

Man-made lightning, **searing** at up to 18,000 degrees, will soon turn hazardous (toxic) and municipal wastes into harmless blocks of glass at a fraction of the cost of current disposal techniques. The process would transform much of the nation's garbage and poisonous waste into paving material. Plus, gases from this process would be about a tenth of that from conventional incinerators.

Continuous bolts of artificial lightning would arc across a nitrogen-filled furnace chamber to create a superheated plasma that would melt most waste products and neutralize molecules of highly toxic chemicals. The electrical charge and high temperatures of the furnace would blow apart toxic chemicals such as solvents, causing the atoms to recombine into simpler, less toxic, and more manageable molecules.

METHANE USED AS FUEL FOR POWER PLANTS

Methane is a basic ingredient of natural gas and the fuel for stoves, water heaters, and industrial machines like power plants. Since rotting garbage in landfills naturally creates methane, about 150 landfills nationwide (in 1998) sell methane. Pipes are inserted into hills of rotting garbage at landfills to collect methane, which is then cleaned of water and grit, and pumped to power plants.

For example, in Orlando, Florida, the Orlando Utilities Commission power plant plans to use methane from the county-owned landfill to supplement its coal-burning plant. The methane will provide electricity to 13,000 homes. In this way, the county benefits because it receives payment for the landfill methane from the power plant. The power plant, in turn, benefits by reducing its fuel costs, and the environment benefits because landfill methane is not released into the atmosphere.

CONCLUSION

Governmental agencies from the local level up to the U.S. executive and legislative branches must constantly be alert to the growing environmental problems that face our nation. Then, they must create and enforce pro-environmental legislation to fight those problems. However, saving the environment is not just the government's responsibility.

All Americans must become more sensitive to environmental issues and determine what they can do to help. After all, environmentalism begins in everyone's backyard — it is everyone's responsibility to preserve and protect the environment in which we live.

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